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EXAMINER	
PADGETT, MARIANNE L	

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1762	8

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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 09/700473	Applicant(s) Paderov et al
	Examiner M.L. Padgett	Group Art Unit 1762

—The MAILING DATE of this communication appears on the cover sheet beneath the correspondence address—

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, such period shall, by default, expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

☐ Responsive to communication(s) filed on 7/12/01 + 6/5/01.

☐ This action is **FINAL.**

☐ Since this application is in condition for allowance except for formal matters, **prosecution as to the merits is closed** in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11; 453 O.G. 213.

Disposition of Claims

☒ Claim(s) 16-30 is/are pending in the application.

Of the above claim(s) ______ is/are withdrawn from consideration.

☐ Claim(s) ______ is/are allowed.

☒ Claim(s) 16-30 is/are rejected.

☐ Claim(s) ______ is/are objected to.

☐ Claim(s) ______ are subject to restriction or election requirement

Application Papers

☐ The proposed drawing correction, filed on ______ is ☐ approved ☐ disapproved.

☐ The drawing(s) filed on ______ is/are objected to by the Examiner

☐ The specification is objected to by the Examiner.

☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. § 119 (a)-(d)

☒ Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119 (a)-(d).

☒ All ☐ Some* ☐ None of the:

☐ Certified copies of the priority documents have been received.

☐ Certified copies of the priority documents have been received in Application No. ______.

☒ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a))

*Certified copies not received: ______.

Attachment(s)

☒ Information Disclosure Statement(s), PTO-1449, Paper No(s). 6

☒ Notice of Reference(s) Cited, PTO-892

☐ Notice of Draftsperson's Patent Drawing Review, PTO-948

☐ Interview Summary, PTO-413

☐ Notice of Informal Patent Application, PTO-152

☐ Other ______

Office Action Summary

U.S. Patent and Trademark Office
PTO-326 (Rev. 11/00)

Part of Paper No. 8

*U.S. GPO: 2000-472-999/43204

1. For the record, the examiner notes that applicant's appear to be using the European convention for naming element groups, such that "Group IV A-VI A metals" referred to in the claims (see claim 16), are discussed on p. 3 of the specification as including Ti, Zr, Hf, V, Nb, Ta, Cr, Mo, W. Therefore, references to groups IVA, VA or VIA in the specification correspond to groups IVB, VB or VIB, respectively in the nomenclutive or periodic table used in the U.S.

2. The disclosure is objected to because of the following informalities: proof reading is needed. For example, proper subscripting is lacking on p.2, line 10. Also, did applicants reality intend to use the copywrite symbol in the note below the tablel on page 10? Note parenthesis at ends of lines by themselves in table 1, ex.#11 and 12; and in #2, what is N+N ? (nitrogen ion implanted into nitrogen gas?) Or should the Ti on the previous line be connected therewith? This is not a complete listing, and it appears that a careful review for computer auto-misscorrection should be considered.

Appropriate correction is required.

3. Claim 24 is rejected under 35 U.S.C. 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

The claim of radiation doses of 1014-1018 ion/sq.cm, and ion energies of 5x103-1x105 eV is new matter, because claim 9 had values of 10^{14}-10^{18} ion/cm^2 and ion energies of $5x10^3$-

$1x10^5$ eV, with page 5 of the specification correspondingly teaching $5x10^{13}$ to $1x10^{18}$ ions/cm^2 and $5x10^3$ to 10^5 eV. As it appears that this New Matter in claim 24 is the results of a typographical error, for purposes of examination over prior art, either set of values will be considered.

4. Claim 24 is rejected under 35 U.S.C. 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention.

As noted above the actual values claimed in claim 24, are not supported by the specification, hence lack enablement therein.

5. Claim 19 is objected to under 37 CFR 1.75(c), as being of improper dependent form for failing to further limit the subject matter of a previous claim. Applicant is required to cancel the claim(s), or amend the claim(s) to place the claim(s) in proper dependent form, or rewrite the claim(s) in independent form.

In claim 19, cathodes are selected from species not within the groups IVA-VIA metals required from claim 16 step (iii). Ti alloys are OK (group IVB-U.S. or IVA European), but steel is iron (Fe based, with both Fe and Ni being groups VIII, so claim 19 improperly broadens the scope of the alloys used in the cathode..

6. Claims 16-30 are objected to or rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Use of relative terms that lack clear metes and bounds in the claims, or in a clear definition in the specification or relevant cited prior art, is vague and indefinite. For relative terms, see "high" in "high energy" (claims 16 and 28); wear-resistant (with respect to what conditions, wear-resistance on a turbine blade is different than wear-resistance on an article such as eye glass frames); and "micro-" in "microlayer" or "micropellets". It is noted that page 3 gives a definition of what a microlayer must contain, but does not discuss whether or not the micro-suffix represents any thickness range limitations or not, or if its just the equivalent sublayer or the like.

In step (ii) of claim 16, while the examiner suspects that the articles or the machine components are intended to be the anode, the phrasing of the claim can be considered ambiguous, sInce "as an anode" could refer to either "chamber" or the articles or components. Either would be logical, scientifically or grammrically.

In claim 16, step (v) and in claim 19, line 4 "machine components and articles" are objected to as lacking a correct article for showing their antecedent basis, or clear differentiation from the previously introduced term. In claim 22, "a microlayer" has an analogous problem. In claim 20 "the numbers"; claim 21 "the thickness values"; claim 23 "the reaction gas" (inconsistent terminology from claim 16, step (iv)); or "the [or said] required plurality of microlayers" (claims 20, 25, 26 or 27, inconsistent since "plurality of" had not been used); and "the [deposited] multilayer coating" (steps (e) of claims 26 and 27), are objected to for lacking proper antecedent basis. Note when referring to previously introduced steps, it would be appropriate to show antecedent basis with the or said.

In claims 25, 26 and 27, the repeating step could be interpreted to be optional, because after doing the previously listed steps, one already has a plurality of microlayers, so they have already been provided. As it is probable that applicant does not intend such, the limitation could be considered ambiguous, and the phrasing reconsidered. It is also noted (but not a formal problem) that in claim 20, since the independent claim already requires microlayers (a), (b) and (c), or 3 microlayers, both claims 20 and 16 has the same minimum number requirement.

Note that unless temporal limitations or anticident basis is used to define an order, that order of listing steps does not necessitate any particular order of doing those steps. This is particularly important to claims 25-27, which when considering the "repeating" steps and format for listing specific materials , give the impression that specific order may be intended, but if it is, it is unclear from the claims since no order is positively claimed, only implied. Also, in steps (e) of claims 26 or 27, since "the multilayer coating" is not clearly associated with any structure in particular, where or when "ion deposition" is taking place is unclear. Also, what is being deposited? The noble gas, Ar?

In claim 28, line 3 "their" in "their mixture" is objected to as being non-standard nomemclature in patent claims, and because possessive pronouns do not always clearly show antecedence. Also, "their mixture or substitution alloys" is ambiguous, because the alloys are not necessarily associated with the pronoun.

Note in claim 16 and its dependants "machine components and articles" could also be considered ambiguous as to whether or not "machine" is suppose to modify "articles", but since

machine articles does to have any particular meaning, or is non-idiomatic, articles will be considered in its generic meaning.

In claim 17, exactly what "vibromechanical treatment with micropellets" represents is not known to the examiner. Mention of this technique was only found on p. 6 of the specification with no further explanation or definition. In the patent literature "vibromechanical" was only found used in describing tactile communication devices and for bonding seams (Savage et al.), where vibromechanical wiping or pressing was said to bond seams and be similar to ultrasonic welding, but no mention of micropellets or how they are used, was found. If the examiner were to guess, she would speculate that some sort of shot preening was involved, but the specification provides no clear meaning, and the treatment cannot be effectively examined without knowing what is involved therein.

7. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made In this Office action:

> A person shall be entitled to a patent unless -
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertalns. Patentability shall not be negatived by the manner in which the invention was made.

8. Claims 28-30 are rejected under 35 U.S.C. 102(b) as being anticipated by Kerber.

Kerber teaches erosion and corrosion resistant (equivalent to wear resistant) coatings on substrates that are melalic, exemplifying turbine blades, thus reading on both an article and a machine component. Col. 1, lines 61-68 notes steel is used for turbine blades. The coatings are multilayer systems that alternate metal layers and ceramic layers (nitrides, oxides or carbides of Ti, Zr, etc.) with a transistion region between them that has a graded concentration of the two materials. Such a transistion region is inherently non-stoichometric and is considered to read on claimed "solutions of nonmetallic atoms of nitrogen, carbon and boron in said metals". Particularly see the abstract; figures, esp. 3; col. 2, lines 3-36; col. 3, lnes 17-41; and col. 4, line 30-col. 5, line 12.

While applicant's do not define any specific ranges of thickness associated with their "microlayers", Kerber teaches values that may be considered to read on "micro" range thickness, specifically 0.10 to 5 μm thicknesses, with different layers being the same <u>or</u> different thickness depending on particular application, exemplifying turbine blades with about 2.0 μm metallic layers and 0.5 μm ceramic. Transisition regions are taught to be 200-300 Å (.2 to.3 nm). See col. 3, line 59-col. 4, line 5 and col. 5, lines 8-12.

Kerber's preferred deposition technique is RF sputtering, which is a plasma technique, hence reads on ion-plasma deposition (abstract; col. 2, lines 19-35 and col. 5, lines 33-col. 6, line 68). Kerber uses the Ti/TiN system as an example, but notes other materials are usable. Col. 5, lines 58-60 teach use of conventional pre sputter substrate etch cycles, ie. essentially ion cleaning , using inert gas such as Ar. Starting off with the metal deposition, Ti is sputter deposited in Ar,

then the transition layer is formed by gradually changing the gas flow by discussing Ar flow and starting and increasing N_2, until pure TiN is begin deposited and the desired nitride thicknesses is deposited, then gas flow conditions are reversed until pure Ti is deposited. This is continued cyclicly to deposit the desired number of alternating layers.

The structure formed by this technique is encompassed by applicants' product claims, since the ion implanting of the 3 claimed layers (metal/metal +nonmetal solution/ceramic) would include producing mixing of layers at the interfaces, which include producing the same kind of graduated transition between metal and ceramic as taught by Kerber. Also note that there is no requirement in the product claims that the claimed microlayer ever had distinct interfaces, and furthermore, it would not matter if they had because the product claims only require that the end results have the same structure, and the claimed ion implantation would have blurred the interfaces of distinct layers, giving structure the same as in Kerber.

9. Claims 16, 18-21, 23-24 and 26-27 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kerber (discussed above in section 8), in view of Suzuki et al (USP 4,683,149) and Dearnaley (USPN 4,629,631).

Kerber differs from the claims by not discussing the metal layer, the non-stoichiometric or solution layer, and the nitride and /or carbide layer as separate layers, ie. microlayers, but as noted above they are separate entities or thicknesses in the 'micro' range, and their ranges of possible thicknesses include ratios as claimed, although not specifically preferred for the examplary end use. Kerber also differs by not discussing cooling and unloading, however in order to use treated

parts, they must be unloaded, and when the deposition techniques which will inherently cause heating of the treated/coated areas, are stopped, cooling will subsequently inherently occur, as no heat is being added and temperatures naturally equalize.

While Kerber's deposition process corresponds as discussed above for steps (i)-(vi), she does not teach implanting one or more layers by non-metallic ions, however Suzuki et al teach the formation of layers (metal or metal nitride (TiN)) on metal substrates, such as steel, via a combination of ion implantation and vapor deposition. Suzuki et al note that ion plating formed films have stronger bonds with substrates then "vacuum evaporation processes, but the bond strength so formed still remains to be fully improved" (col. 1, lines 29-32). Note that as Kerber may use substrate biasing with their sputter deposition, that it may qualify as an ion plating related process. After Suzuki et al's initial cleaning and activating step (i), base layer deposition (step ii) is followed by ion implanting with 10KV-100KV ions (Ar, Xe, N), and further steps include further depositions the desired number of times via vapor deposition or ion plating, with or without ion implantation. Whether or not ion implantations are employed with subsequent layers, is taught to depend on the quality of the adhesion of that layer. Suzuki et al's examples employ the ion implanting with both pure metal deposits (use inert gas ions, such as Ar or Xe), or to produce nitrides like TiN, via N implant. See the abstract; fig. 1-8; summary, esp col. 1, lines 44- col. 2, line 4; and col 2, line 56- col. 4, line 6. In the production examples, note Ar^+ at 40 KV and 10^{-16} - 10^{17} ion/cm^2 were employed to implant metal, or 30 or 40 KV N^+ at doses of $7x10^{16}$ to $3x\ 10^{17}$ or 5x10 ions/cm^2, respectively, were used for TiN.

Given these teachings of Suzuki et al, it would have been obvious to apply ion implantation as taught therein to the physical vapor deposition process (sputtering that may be biased) of Kerber, in order to achieve to the improved adhesion taught to be produced by the use of that ion implanting especially for Kerber's initially deposited metal layer, since improving its adhesion to the substrate will improve the overall wear of the object. As noted in Suzuki et al, the use of N^+ implantation will also improve the adhesion of nitride layers to metal substrates, which is analogous to underlayers, especially in view of Suzuki et al's suggestion for more layers, ie multilayers, hence application to any of the successive layers in Kerber would also have been obvious. Also note that while figures 1-3 show ion implantation following deposition, that Suzuki et al's fig. 4 supplies an alternative teaching of simultaneous deposition and implantation, so no interference with Kerber's teachings would come form employing Suzuki et al's teaching therewith.

Dearnaley is cited to provide further showing that the deposition techniques of Kerber (sputtering) and Suzuki et al (electron beam evaporation illustrate d in Fig 1-2) may be equivalently used for providing surface treatments to increase wear and hardness (abstract; col.1, lines 4-56, esp. 41-43). Note that besides the nitrides taught in both references forTi, and the carbides or carbonitrides taught by Kerber for Ti or Zr, Dearnaley et al equivalently teach the use of B^+ to produce borides of Ti, Ta, Zr or Hf, hence it would have been further obvious to one of ordinary skill in the use B^+ and borides for making hard coatings as suggested by the combination

Kerber and Suzuki et al, as such B ions are shown to be equivalently used in analogous methods by Dearnaley.

While Kerber does not provide an example that totally stops the Ar flow when the pure nitride layer is being produced, it would have been obvious to one of ordinary skill in the arts to vary gas properties depending on particular apparatus and other parameters to achieve the taught effects of Kerber, and just N as opposed to significantly increased N_2 with decrease Ar, would have been expected to be within routine experimental variations, as it is consistent with taught trends. Kerber also does not teach use both TiN and ZrN composites on the same substrate, however as both are taught to be effective for the same purpose, and repeated multilayers are taught, it would have been obvious to one of ordinary skill as suggested by these teachings, since as both are similarly useful, they would retain these properties used separately or together, but as they are not identical in some environments one may be superior to the other providing better over all protections.

10. Kobayashi et al is noted to be equivalent to Suzuki et al for providing alternative equivalence of PVD techniques for providing the metal deposition component (abstract; col. 1, lines 11-21 and 40-55).

11. Claims 22 an 25 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kerber in view of Suzuki et al and as applied to claims 16, 18-21, 23-24 and 26-30 above, and further in view of Engel.

The above combination does not teach an initial deposition of Sc or rare earths, however Engel who is also teaching a hard coating process of deposition with carbonizing, boriding or nitriding, teaches an initial metal deposit before the metal that is to be nitrided (etc.), where metals deposited include Sc, Ti, Zr...lanthanide and actinide series (abstract, summary), and that the initial metals and later deposited metals may be different, but chosen from these elements. Note Engel's ion plating deposition and nitriding, carborizing, etc., that may come from plasma are analogous to the above combination, hence it would have been obvious to one of ordinary skill that effective metals as taught by Engle would have also been expected to be useful and effective in the above combination.

12. Claim 17 is rejected under 35 U.S.C. 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention. As noted at the end of section 7, what actual actions or effects are embodied by the claimed "vibromechanical treatment" are not explained by the claims or specification, so the disclosure lacks clear enablement.

13. Other art of interest include Kennedy et al with teachings of graded nitride or carbide vapor deposits of Ti or Zr metals deposited by a PVD process using substrate bias. Kennedy et al has teachings similar to Kerber, but has only one set of graded layers, and deposits by evaporation instead of sputtering. Kukino et al cited by applicants is noted to have further teaching concerning multilayerd hard coatings and materials used therefore.

Kiyama et al, Hashimoto et al, Shimizu et al and Zhed et al and Japanese patents to Sato et al, Matsuura et al and Suzuki et al. have further PVD processes that are assisted by ion implantation to produce wear resistant coatings of materials of interest. The UK patent to Dearnaley et al is cumulative to Dearnaley and Suzuki et al as applied in the above rejections.

14. Any inquiry concerning this communication should be directed to M.L. Padgett at telephone number 703-308-2336 on Monday-Friday from about 8am-4:30pm; and Fax #(703) 872-9310 (regular); 872-9311 (after final); and 305-6078.(unofficial)

MLPadgett:evh

8/16/02

9/24/02

MARIANNE PADGETT
PRIMARY EXAMINER